Hypodensity/Hyperdensity

or

Apple Skies

by

Gabriel Cira

Submitted to the Department of Architecture in Partial
Fulfillment of the Requirements for the Degree of

Bachelor of Science in Art and Design

at the

Massachusetts Institute of Technology

June 2008

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ABSTRACT

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Connecting modes of transportation allows an assembly of physical form as a paradigmatic juxtaposition. The site, currently empty and infertile, will contain an ideal urban condition of high-density living and the ideal rural construct of an orchard. These two polar opposite conditions are symbiotic in the site, creating a completely unique mode of living that is not isolated from the existing fabric of the surrounding area.

Thesis Supervisor: Mark Jarzombek
Title: Director, History, Theory, and Criticism of Architecture

BIOGRAPHICAL NOTE

At MIT, Gabriel Cira majored in Architecture while minoring in Comparative Media Studies and concentrating in Visual Art. He took a wide variety of classes in Computation, Philosophy, Film Studies, and Media Arts and Sciences in addition to the core subjects, and undertook multiple UROP projects under both Wendy Jacob and Meejin Yoon. Outside of classes, Gabriel was on the MIT Varsity Sailing Team for all eight semesters, and was an active supporter of the Boston music scene as a member of MIT's radio station, WMBR 88.1 FM.

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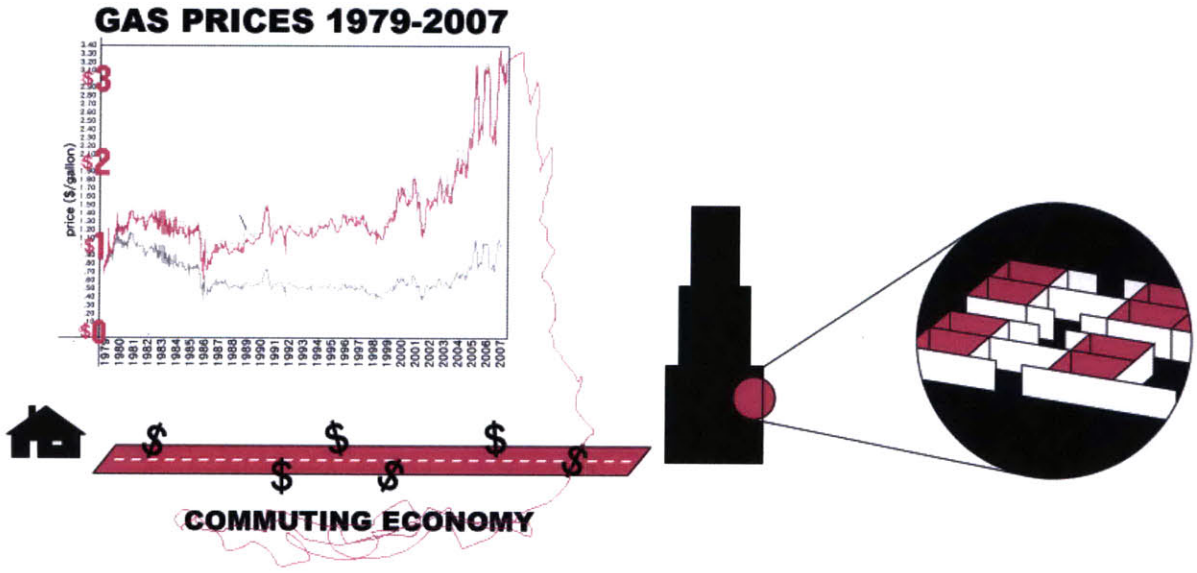
Special thanks to my thesis committee, Mark Jarzombek, Alexander D'Hooghe, Eric Höweler, and William McKenna, for their support, criticism, and advice over the course of this project, from initial pipe dream to finalized pipe dream.

Thank you to Meejin Yoon, Dan Chen, and Meredith Miller for additional advice on this project and life in general. Thank you to Elizabeth Krasner and Brooke Jarrett for advice, support, and much-needed help constructing the final model.

HYPODENSITY/HYPERDENSITY

or

Apple Skies

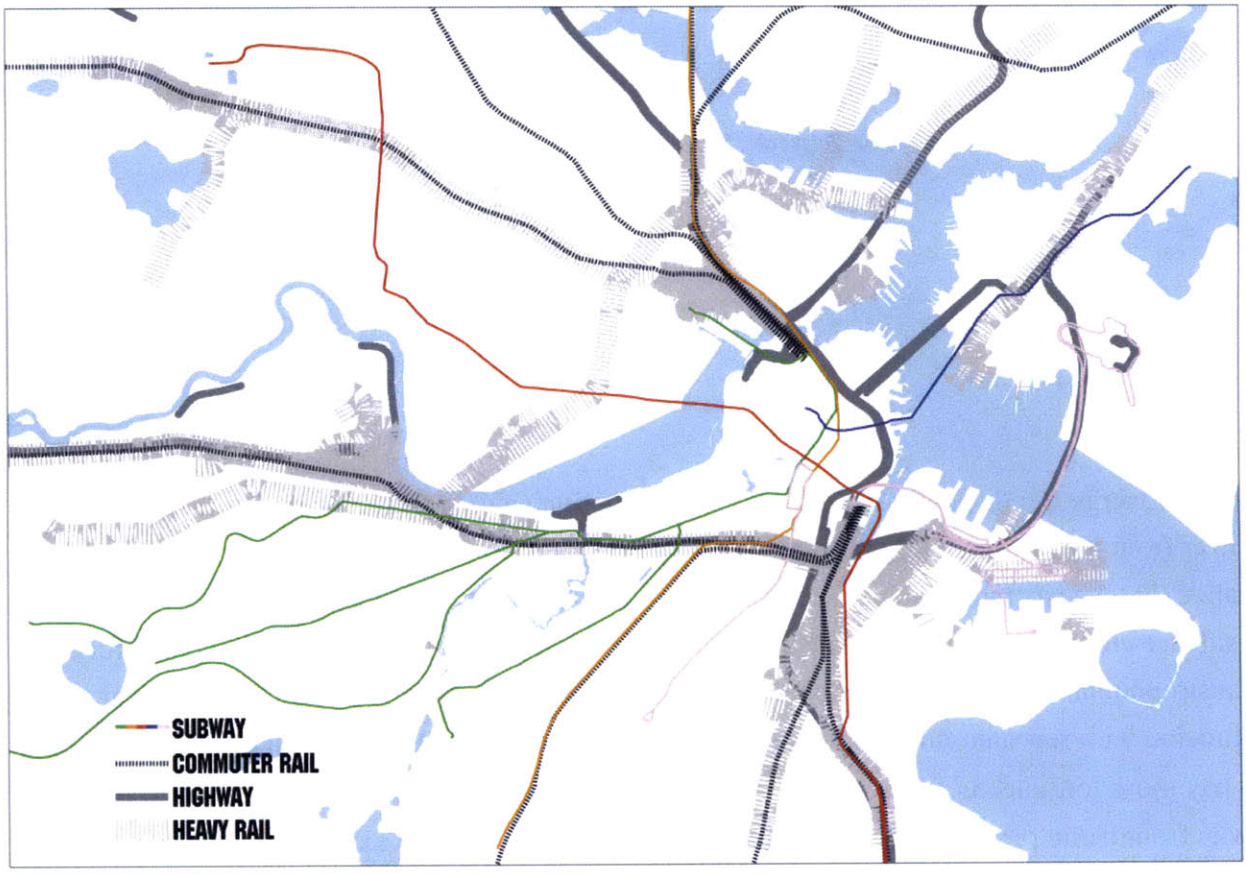


Current energy trends point towards a global production peak in 2010, beginning the shift of power from the buyer (in this case the commuter) to the seller. As American oil consumers realize that it costs more each day to drive to work, they will be more likely to seek residence closer to the city. Architecture can seize this impetus to begin to eliminate the fear, claustrophobia, and dehumanization that are associated with city living. Strictly, a vertical extrusion with repeated floorplates is the cheapest building to build. But with commuters willing to pay more for housing that reduces their need for transportation, buildings can start to move away from being pieces of economic machinery. They can be more exposed and livable while maintaining the mass that allows hyper-density, ease of construction, and energy efficiency.

image: Osmosis, Inc

image: flickr.com user 'picinin'

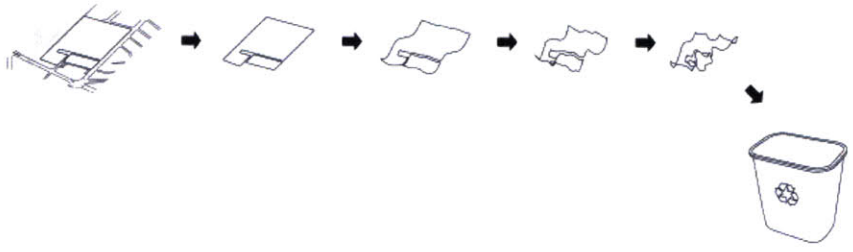
The analogy of the American transportation system to a human circulatory system inherently plans for its destruction, as each personal unit eventually will no longer be able to function apart from 'the grid.' A new urban/ultra-urban analogy (paradigm) needs to be assigned.

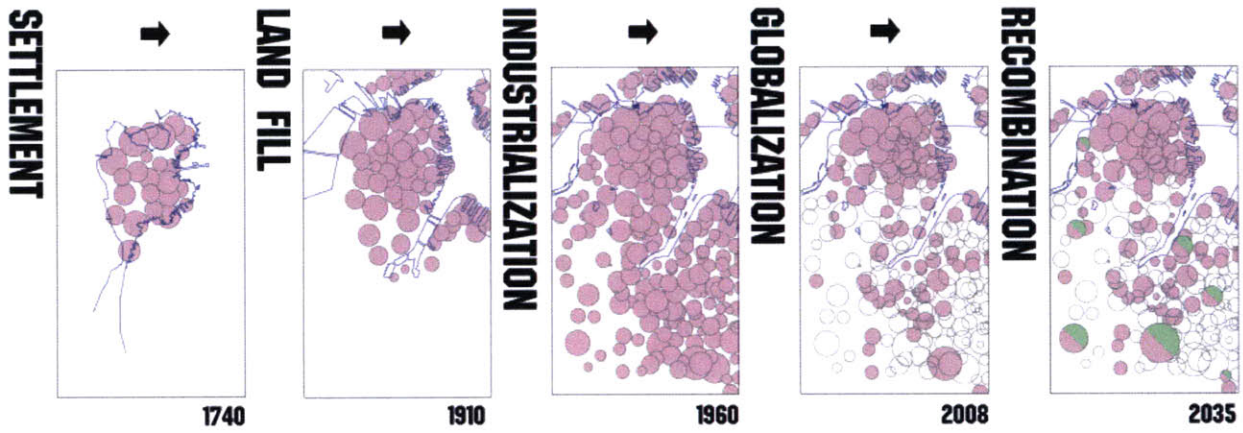


This map shows the existing transportation modes of the greater Boston area. Line weight is used to illustrate the amount of land area that is directly and indirectly taken over by the gray sprawl of transportation infrastructures. The sites outside the city center, among the 'collisions' of different modes of transportation, are the test cases for this project.

Cities require an array of support systems that tend towards each other as they approach the city. Railyards, highway interfaces, large vehicle parking and other utilities need to be close to the areas that they serve, but 'out of sight' of the city center. This creates a ring of Drek that chokes urban growth in favor of suburban sprawl outside it. Architectural treatment can clean these areas and incorporate them into the city, allowing the brownfields to be built up and the strands of transportation infrastructure to be woven among the buildings.

This mid-range city area thrived during the industrial boom of the early to mid-1900s. Most buildings are single-story warehouse buildings that cover the ground like a mat. In a city center, space is at a premium and a tall extruded building is economically best. The 'mat buildings' are a unique reaction to this city condition because there is no shortage of space, and the ground itself is not worth revealing for it is infertile.





The current state of these gray areas in American cities is 'paradoxical emptiness.' Globalization quickly outdated the fantastic amounts of American industrial facilities that occupied this region. The workers, both specialized and unskilled, were steadily displaced from their jobs; the wealthier could afford to relocate, and the poorer who stayed were more likely to be homeless or involved in criminal activity.

The last phase of this diagram represents one solution: a typological trend that can be achieved through progressive design on a realistic *architectural* scale rather than attempting to change the way the entire city of Boston operates. In as many situations as possible, this project stipulates modularity. Given the cost of construction and manufacturing, this project is most likely to be realized by a single private developer on many sites. The system herein detailed is meant to be a solution to local ailments that can be repeated, or 'grow' as the demand dictates both within a site and to multiple sites. It ultimately has sustainability, economic growth, and architectural amour as its goals.

Architectural amour is a construct that surpasses beauty and function. It is an unknowable resonance that occurs when an inhabitant is able to fall in love with their surroundings for reasons other than its convenience, price, and views. This is a function of community, and faith in a *design* system that is not 'governed,' but instead rule-based, with human accommodation as the most basic intention of the rules.

This project is a reaction to unplanned sprawl as well as the hyper-planned alternatives. It makes an effort to be as gentle as possible with governance while preventing growth that is a propagation of economically safe sub-growths. The architectural amour is a result of knowledge that this development has helpful humanistic intentions on every possible scale.

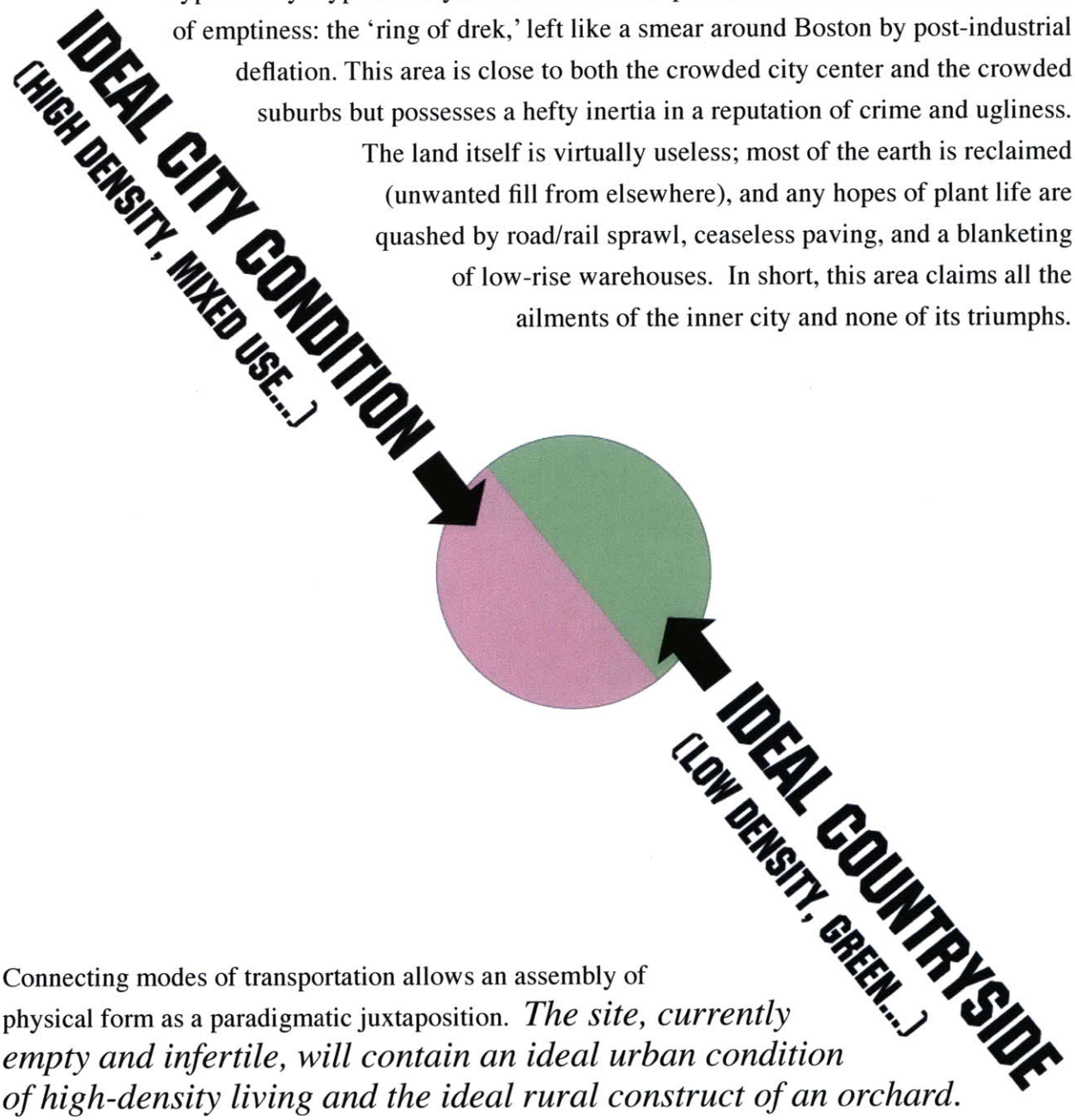
Historically, the land surrounding city fringe transit stations is unbuilt or derelict because of the crimes, homelessness, and emptiness that are associated with these areas. With the force of necessity, this property can be acquired (cheaply enough for its inherent market risk) and architecturally reconsidered. These sites have the unique ability to be connected to the public transportation hub. In these areas, the introduction of a human hive with careful consideration for the pathways and enclosures connecting the structures will propagate positive growth in the surroundings. This is an aerial view of the site, a vast (9 acre) plot of empty land. The white building in the lower right corner is Andrew Square MBTA station, which is on the Red Line and is a major bus terminal.

This site is at a meeting point of several modes of transit: heavy rail, commuter rail, subway, bus routes, and highway. However there is no confluence at this crucial node, merely crossings. The site itself is in a limbo between these 'stripes;' it is amazingly open yet neatly boxed in.

Boston has vast quantities of land that is very similar to this site. Lechmere, Charlestown, East Boston, and Allston contain sites with equal connection to transit, and equal openness caused by both reckless application of these infrastructural pieces, and undesirability caused by them.

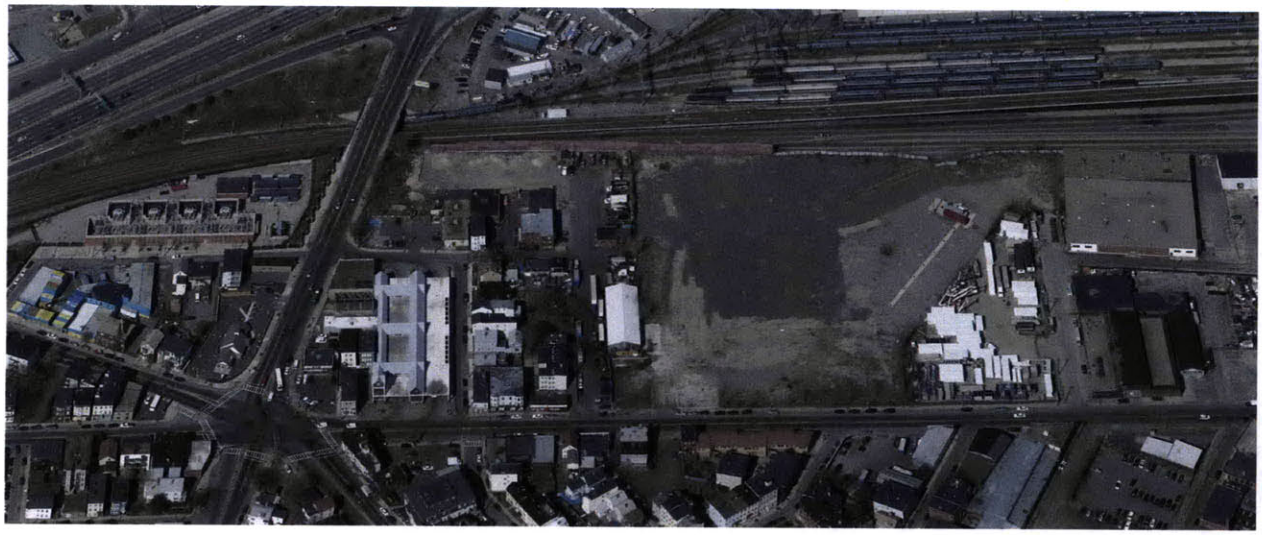
According to Massachusetts government data, this particular site is owned by MKM Ventures LLC, which is registered as a small real estate firm, most likely a puppet company owned by a giant landowning venture company in order to avoid taxes. There is no signage on the site displaying its owner or any plans for its use. Revealing information about this site is as difficult as digging through the rocks and rubble that cover it.

Hypodensity/Hyperdensity is a reaction to the paradoxical modern urban condition of emptiness: the 'ring of drek,' left like a smear around Boston by post-industrial deflation. This area is close to both the crowded city center and the crowded suburbs but possesses a hefty inertia in a reputation of crime and ugliness. The land itself is virtually useless; most of the earth is reclaimed (unwanted fill from elsewhere), and any hopes of plant life are quashed by road/rail sprawl, ceaseless paving, and a blanketing of low-rise warehouses. In short, this area claims all the ailments of the inner city and none of its triumphs.



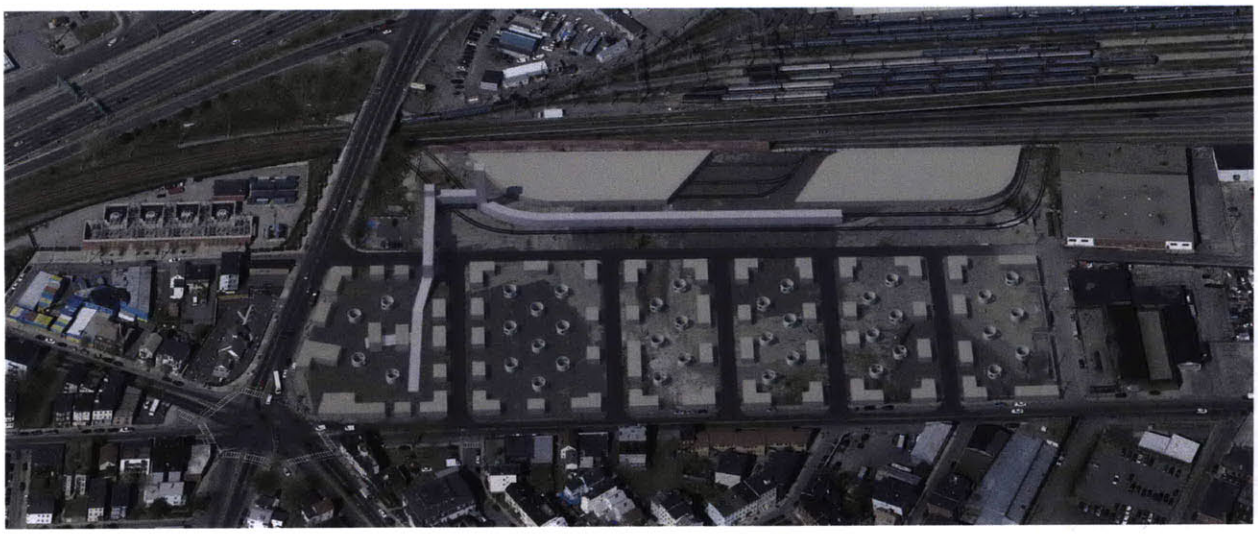
Connecting modes of transportation allows an assembly of physical form as a paradigmatic juxtaposition. *The site, currently empty and infertile, will contain an ideal urban condition of high-density living and the ideal rural construct of an orchard.* These two polar opposite conditions are symbiotic in the site, creating a completely unique mode of living that is not isolated from the existing fabric of the surrounding area.


EXIT



The above image is the site as it exists. The development plan is broken into phases that are structured not by definite deadlines, but by ranges of years in which that level of growth is expected to be achieved. This allows the system to respond to economic forces and the demand for its services.

Phase 1 is shown below, with a time frame of under one year. Andrew station and the run-down buildings that surround it are removed and new roads are paved through the site. Train tracks are extended onto the site; the inner set connects to the Massachusetts heavy rail system, and the outer set connects to the MBTA commuter rail network. All future development on the site will use heavy-rail train delivery for raw materials and machinery. This reduces delivery cost and energy usage, and allows deliveries to be incremental and need-based rather than scheduled.



The second phase must happen quickly; under three years. This is the phase in which the site-specific and non-modular infrastructures of the system are built.

The most important action, and therefore first, in this phase is the creation of a commuter rail stop that provides an interior connection to the underground subway stop. This part of the project is not intended to be a 'superstation' or any type of human connectivity hub. It is simply meant to be a utilitarian service tendril that provides a direct interior connection across the huge site. Mobility and connectivity are of paramount importance in a development that seeks to thrive as gas prices skyrocket. The final plan as well as the growth system incorporate and celebrate outdoor connectivity, but during especially cold or rainy days an interior connection to one's destination is crucial.

This development disregards the traditional high-rise act of replicating the ground plane. In this case value is not gleaned from the site, but purely from the architecture. Therefore the ground level is taken for exactly what it is, a convenient coplane to the rest of the world — no more.

Two buildings are added which replace the undesirable ground level portion of the site that faces the railyard. One is a factory building where the living units are assembled, and the other is storage space and parking. Due to their location on the far side of the commuter rail stop (and ultimately being covered by housing units) these buildings are all but forgotten. They silently serve their specific functions and do not interfere with the rest of the architecture.

Concrete is used only in the creation of the retainer buildings and the above-grade waste processing system. The retainer buildings range in size from 600 square feet to 2000 square feet, and house stores, shops, restaurants, etc. They continue the rhythm of the city experience, and will later brace and contain the soil plinths.

The waste processing system consists of a distribution system that is laid above-ground on the block interiors. In the third phase, depicted above, soil is imported via rail and fills the block interiors, covering the waste distribution system. As the development is inhabited, human waste will flow from the units to the soil. This integrates and marries the two polar components of the project together systemically.

Foam-flush toilets are used throughout the development, which both conserves water and makes the human waste suitable for fertilization. The large scale of the housing development makes the treatment and distribution much more regular and efficient.

Full service of the Andrew Square MBTA station is regained after a short period of time. In the existing station, buses stop under an oppressive mass of building. After this phase, a passenger finds himself looking across five acres of fertile ground as he steps off the bus. Buses now stop on top of the South block — their actual path is exactly the same as before, but now they are allowed to engage the great length of the site.

Also during this phase the service shaft grid begins to be constructed. This acts as a 'trellis' that allows unit propagation among its members. Half of the service shafts contain elevators, and half contain staircases. Unit will span between two shafts; therefore each will have direct access to an elevator, a fire stair, and a secondary exit pathway on the elevator shaft side. This pathway is created by the propagation of units around and down the trellis. Each unit contains a staircase segment and some contain public shaft-spanning segments. The service shafts hold elevator machinery which can be connected to a hoist system atop the shaft. Through precise winching, units will be delivered from the factory to their place between two shafts.

The first two families can move in as soon as the first unit is placed and connected.

In the next step, maximum possible unit density (allowed by the unit pattern) is achieved on the Northwest area of the site. The remaining service shafts are added across the site, with a range in size that will dictate the amount of units that can be directly above the orchard. This insures that the orchard will receive ample light, and will create a natural price range in the units due to location. Since a unit must be connected to the unit below, each one has a private or semiprivate exterior space, depending on the arrangement and type of units around it.

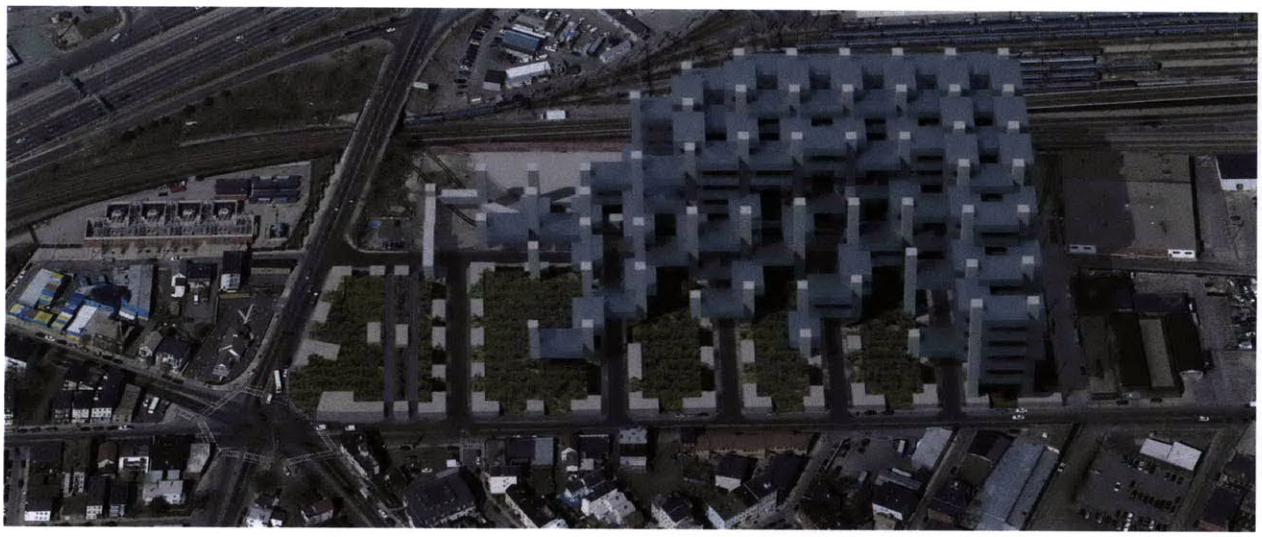
The plinths are planted with apple trees which will grow quickly due to the augmented nutrition of the soil and its depth (10-12 feet). The gaps between the retainer buildings allow the soil to slope downward, and the roots of the trees prevent serious erosion. After some time, the street-level storefronts will alternate with shady orchard edges, creating a unique and pleasant streetscape. Additionally, the grids of trees and the openings between them provide countless pedestrian pathways across the great site.

The corner of the site that interfaces with Andrew Square is a fanning slope of trees that are an invitation to the surrounding community and to prospective inhabitants:

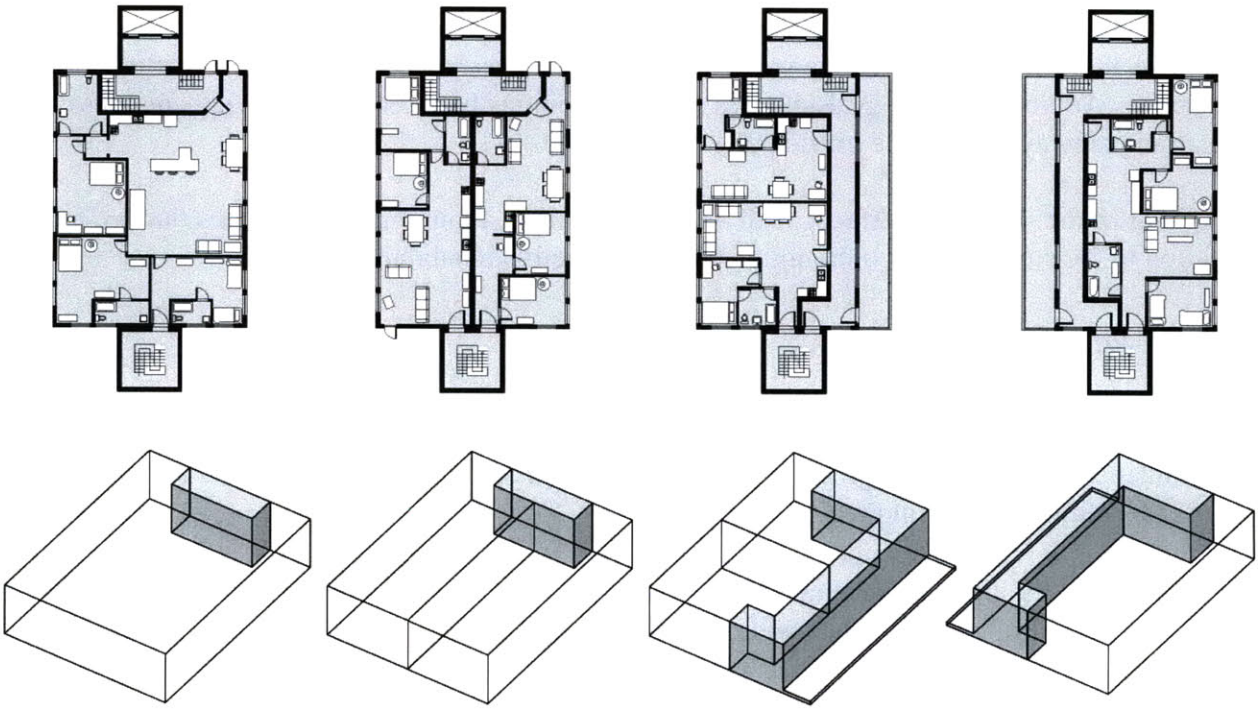
"Come eat apples!"

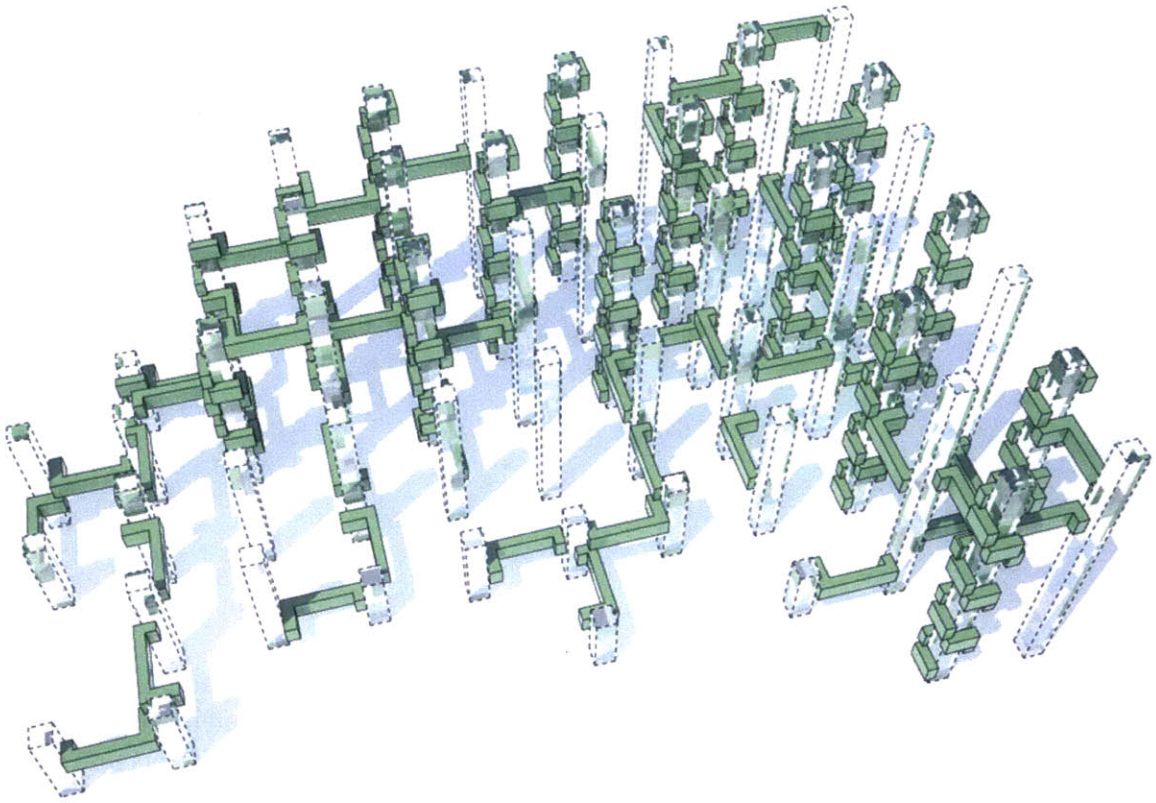
The two buildings that border this tumble of trees become the 'business face' of the development to the outside world. One is a grocery store that excels in apple products and varieties. The other is the administration and realty office.

The term 'realty' is slightly inaccurate for this development. The word is related to 'reality,' 'royalty,' and 'realm,' denoting the ownership of land. This project seeks to ignore the (sub) conscious concept of land ownership as proof of legitimacy and reality. In sites of this typology there is no "reality shortage," there is reality abundance — *Reality is not valuable.* Reality is rocks and garbage and old pavement.



In the final phase, units are created and slotted into the trellis as the demand for them dictates. The units will create twisting, intertwining pathways from the areas of higher density down towards the areas of connectivity and greenness. A working resident is able to choose from a variety of routes to and from the T. Some are completely interior, some cut across orchard blocks, some might change or bifurcate suddenly with the addition of a unit.

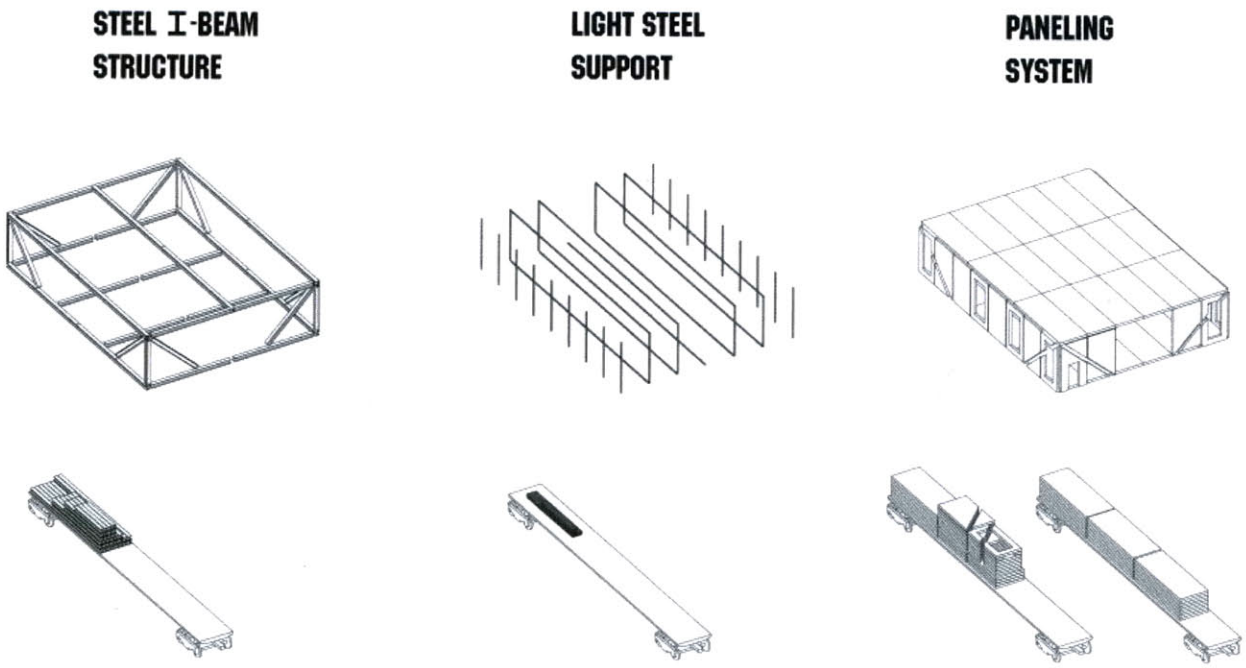




All units have a staircase segment on the side closest the elevator shaft. This insures a continuous exit pathway that twists around and jumps between the service cores. This diagram shows only public circulation, which uses less than 10% of floor area in the modular units yet creates dynamic, vinelike pathways downward.

A resident will always have three main routes to the ground; two stair-based paths and one elevator ride. Both stair-based routes may fork at any time, creating many subroutes. The elevator route and one stair-based subroute always will deliver the user to a point directly under his or her unit.

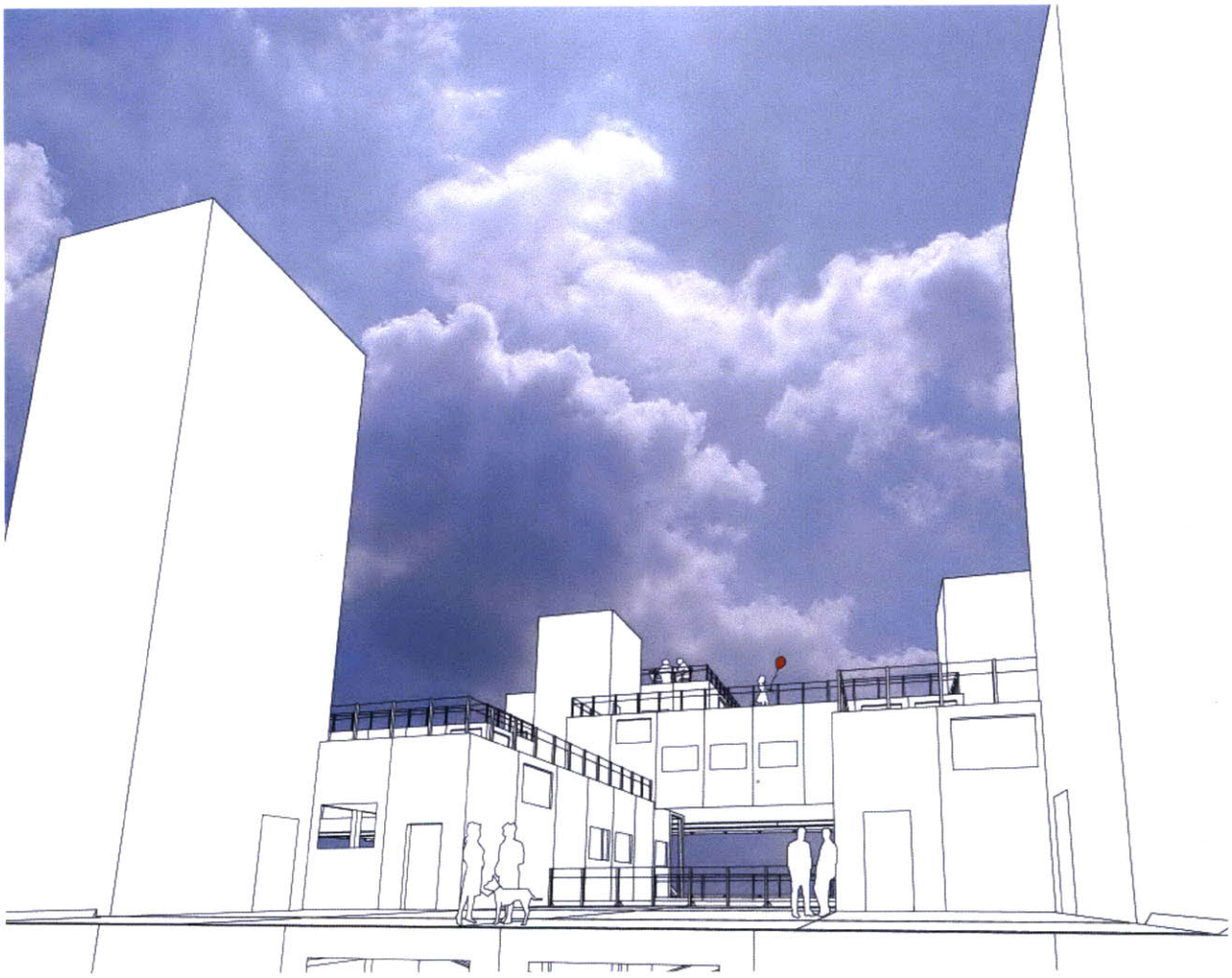
All hallway segments have a windowed wall, and all stairway segments have a door and window to the roof of the unit below. The individual homes inside the living units always group kitchens and bathrooms towards the service core attachment points, making plumbing as simple as possible.



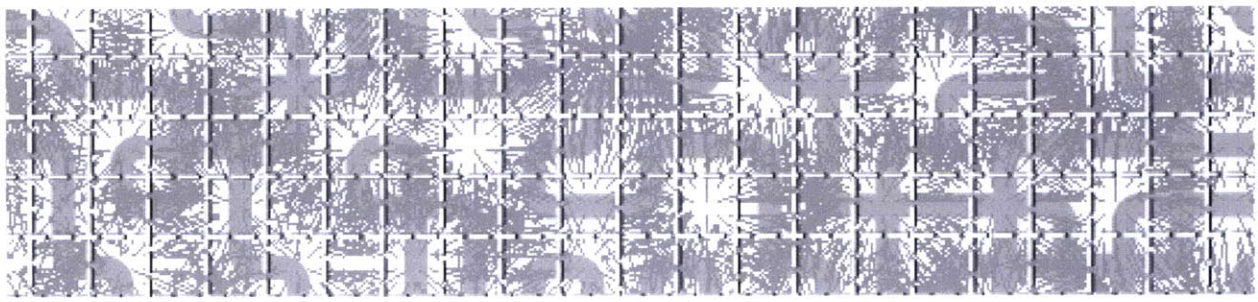
The structural system of the unit modules continues the range of building materials that are self-stuctural, discrete, and easily attachable. The above diagram shows the three levels of a unit's structure and their collapsed volume. In total, the material from one unit would occupy about two flatbed train cars. This material would be assembled into panels, structural frames, and other building components in the onsite factory. Completed panels and structural members can be assembled immediately into units and hoisted onto the trellis, or can be exported to other satellite developments that do not have unit factories.

The panels themselves have only two layers: waterproofing and structural insulation foam. Because of this, they are easy to fabricate with wide range of window shapes and arrangements. Since the foam acts as both structure and insulation, it must be quite thick (~10 inches) to be sturdy enough. This makes for excellent winter heat efficiency in the units, and in the summer, vents can be opened to draw cold air from the service shafts.

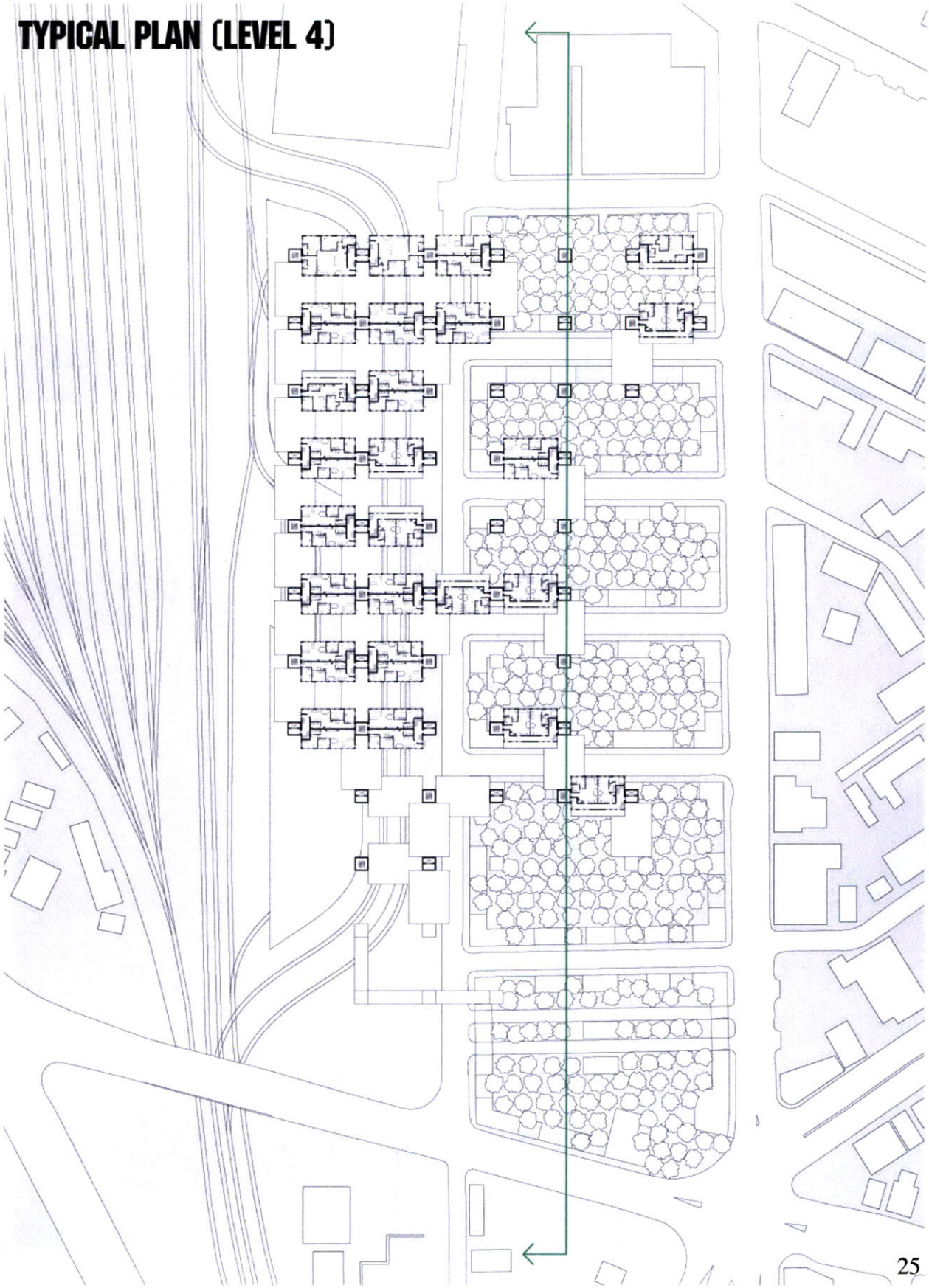
Both the I-beam and light steel structure are equipped with attachment points for the paneling system which insure that each panel will fit snugly against the adjacent panels. Interior finish layers and exterior waterproofing seams are added after assembly.

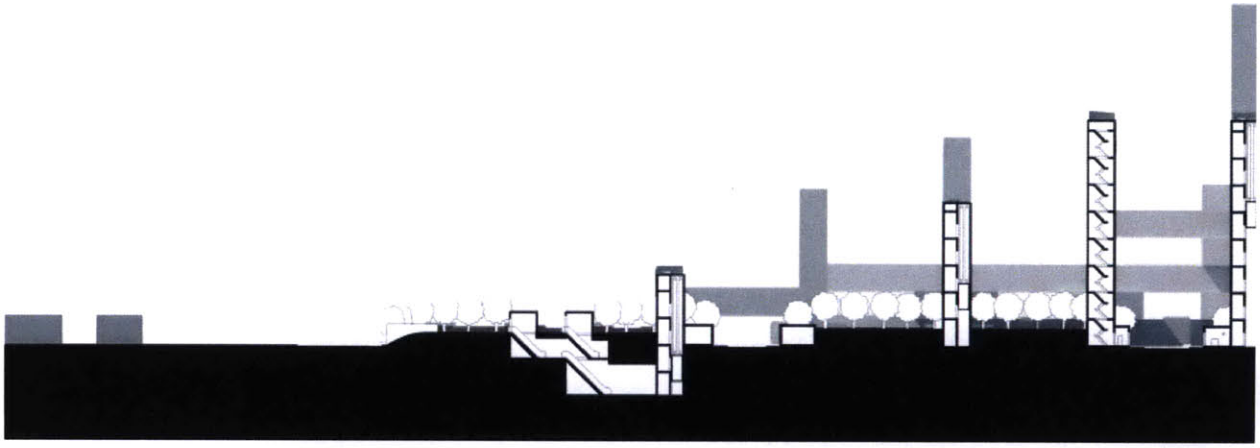


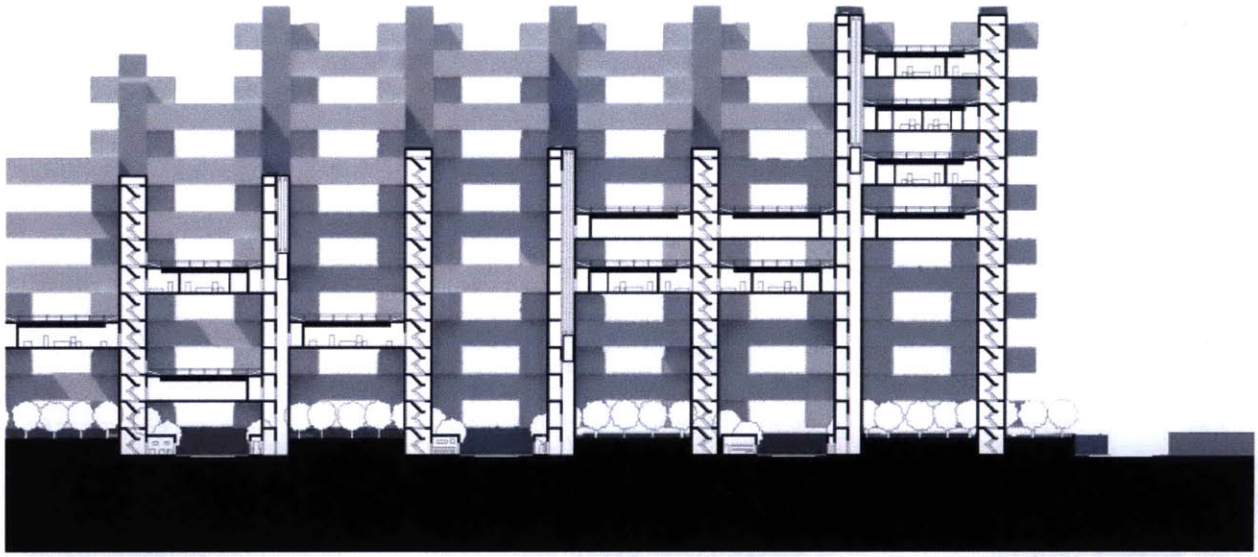
In Apple Skies, there is no provided replacement for a neighborhood street. The 16-foot-square service cores certainly are not cramped, but do not provide the linear visibility of an avenue or even a hallway. A unit's 'neighbors' in Apple Skies are not defined numerically by placement next to other units, but by much more informal secondary and tertiary connections. Pathways of human movement through and atop units define physical neighbors, and visual cross-connections make a network of sightlines that create non-physical neighbors. *This system of overlaying patterns not only creates unique exit routes but defines a complex landscape of visual and physical human connections.*

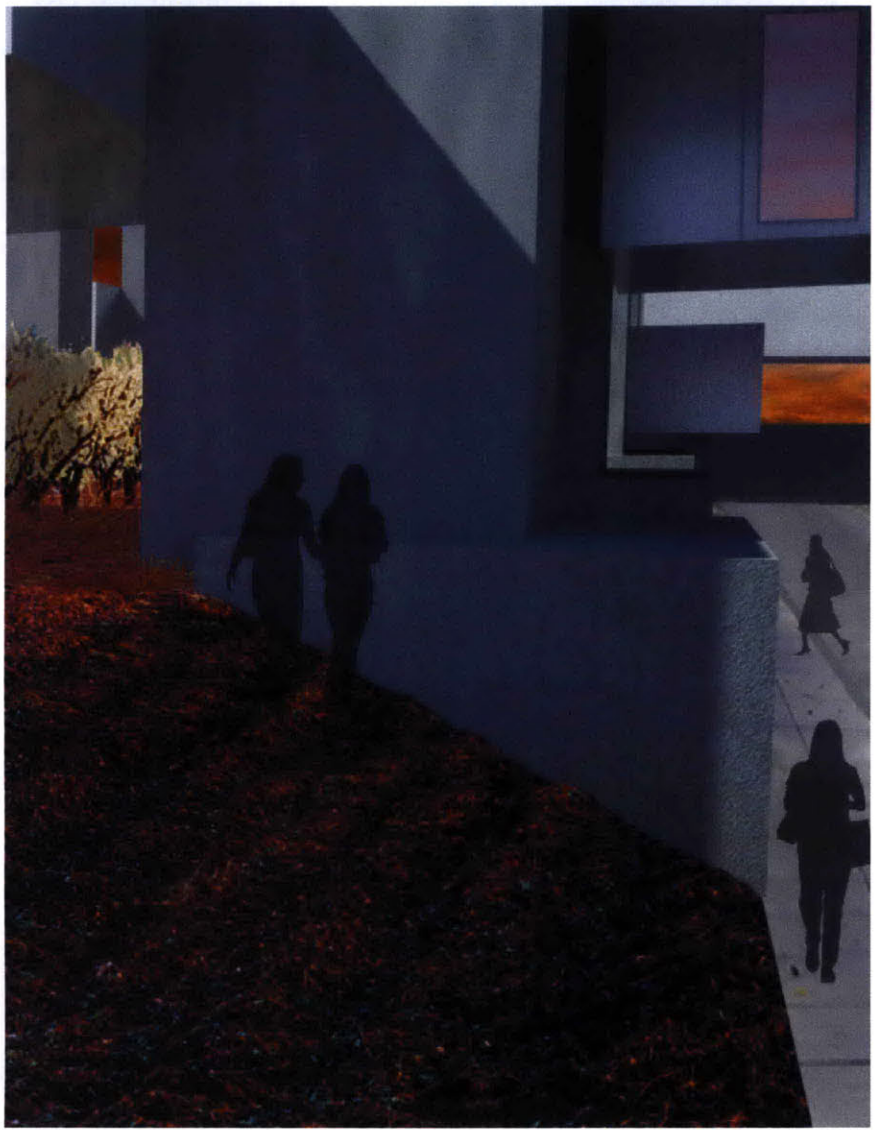


TYPICAL PLAN (LEVEL 4)









The pathways that result from the propagation of the stacking pattern somehow defy representation in traditional plan and section. The plinths, which define the orchard landscape, often have units hovering high above them. This creates a variety of sectional qualities and a stimulating ground experience.

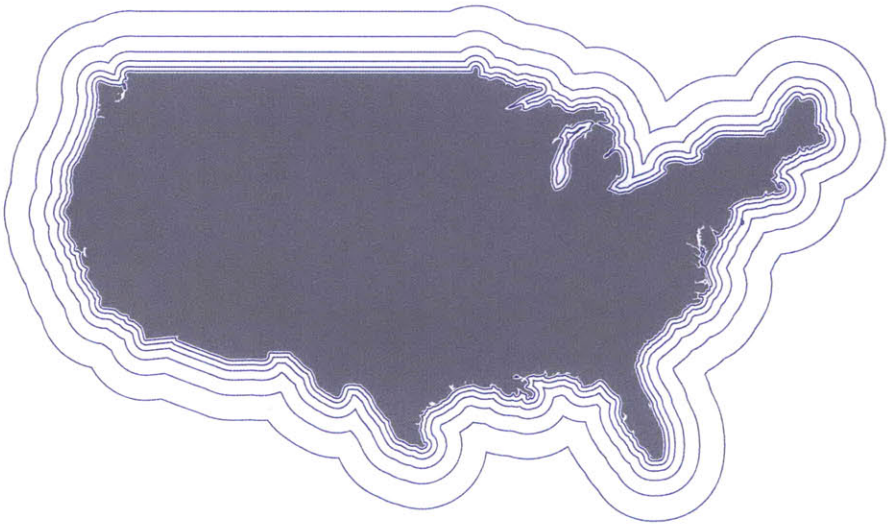
This couple walked from the bus stop up to a vantage point near the unit factory. They are now watching their new home being hoisted into place among the other units. The cranes that top each service shaft 'relay' the unit lengthwise through the space between them, then slot it in diagonally and level it. The winches are precisely controlled for ease of manipulation and safety. Once a unit is set, it is bolted in place, the plumbing and electric systems are connected, and the connection is insulated and sealed.

The realty office allows prospective inhabitants to design the layout of their unit and choose its position on the trellis. Both design options are governed by a set of rules that insures the creation of a healthy development. For example, there are rules about minimum height and unit density above the orchards to insure adequate sunlight.

The American Dream of a personal homestead 'domain' has been machined into suburbia, the malignant growth of America. The Garden City movement and the New Urbanism movement carefully planned alternative suburbs which included strategic green space and town centers. Apple Skies allows users to generate their own living space, contributing to a sense of personal habitat. The orchard is not a sequestered plot but an interface to the outside world that the housing grows out of. There is no possibility of 'gray area' forming between the housing and the orchard; the threshold is clearly defined and articulated.

American children commonly want to be astronauts and cowboys when they grow up. But the frontier that is home to the cowboy spirit has all but disappeared. It is easy to imagine cowboys exploring their way to the West Coast, and instantly abandoning their steeds for surf boards. California is 'the cowboy graveyard.' Astronauts, on the other hand, explore an inexhaustible frontier. They do not deal directly with the idea of land, but with *space*. A cowboy is a 2D astronaut.

Is it a coincidence that both jobs in reality are marked by solitude and often ennui? *There is an American collective unconscious that desires and idolizes loneliness.* American vernacular architecture reflects this psychological phenomenon, from castle-like seaside mansions to mountain cabins and party walls. This is not an evil but a design guideline. The units in Apple Skies imply autonomy, yet are connected enough to provide human conveniences: water, electricity, and mobility.



Apple Skies eliminates any ideas of land ownership. It spatially entangles pathways, public space, and private space so systematically that there is no possibility of domain accumulation or stratification. In addition, it retains and celebrates kernels of American personal space.

Apple Skies does not rely on its uniqueness to attract inhabitants, but on its programmatic juxtapositions and the individual treatment that it gives individual users. Rather than artificially redecorating a region, it uses formal scraps from the area to synthesize a more desirable way of living, which will trigger a *natural* revitalization.


DELI
SUNDRIES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